INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
MATERIALS MANAGEMENT DIVISION

PR No.1000048943 **RFx No.6100002322**

Technical specifications for thin film thermal conductivity measurement tool (1 Unit)

Sr. No.	Description	Value / Range	Technical Compliance (YES / NO)	Additional Information (if any)
	Key Generic Requirements:			
a.	The tenderer must provide an installation scheme showing the physical space (footprint) of the machine(s) as well as space required for routine access and all installations including any related accessories.			
b.	The vendor should preferably have experience in installing similar types of systems in Centrally Funded Technical Institutes (CFTIs), Government Research Laboratories, or reputed Private Institutes. The vendor must provide at least two (02) Purchase Orders (POs) along with a corresponding user list as supporting evidence.			
c.	The compliance sheet should be provided by the vendor. The absence of the compliance sheet may result in the cancellation of the purchase order.			
d.	For each compliance, supporting evidence such as manuals and other necessary and supporting documents needs to be provided.			
e.	The vendor should have an Indian trained technical representative who can take care of urgent troubleshooting or any measurement-related queries on an urgent basis.			
f.	Safety features like interlocks to prevent errors in operation and emergency shut-down options should be available.			
	Technical Specifications (Generic):			
a.	The system must be semi-cleanroom compatible with all the necessary support systems, such as vacuum, cooling, power supply systems, computer hardware, and software.			
b.	The machine must be software-controlled with appropriate software and hardware interlocks to protect the machine from any possible operational or non-operational failure, thereby ensuring the safety of the operator and the machine. The system should also incorporate software support to control and monitor thermal properties of materials, guaranteeing ease of use.			
c.	The tool must contain all the necessary sensors and controls for safety and performance monitoring. A complete set of system operation and maintenance manuals must be provided.			
d.	A library of material properties for extraction of different parameters processed by the machine, well-documented by			

	the company, must also be included.			
e.	The control computer system/PLC should be state-of-the-art, with a pre-loaded operating system and the software required to run the machine. The control panel must contain all the buttons needed to operate the machine.			
f.	The software must allow for configurable user groups with different access privileges. Three different modes, operator, engineer, and admin, should be provided for easy and safe handling of the tool.			
g.	The software must allow the user to write and edit machine recipes.			
h.	The software must provide full system monitoring and recording of full system states in log files.			
i.	The system must provide access to sample measurement history and security protocols.			
j.	The system must provide system fault detection and diagnosis.			
k.	Automatic and manual control modes should be available in the software. The system should provide programmable control over all thermal parameters.			
l.	The system should be configurable for various environments, including air and inert gases.			
	Technical Specifications (Specific):			
A.	**Thin film thermal conductivity measurement tool:**			
1.	Thermal conductivity tool housing	Floor Size should be specified in terms of width, length and height. Material: Stainless steel with cleanroom-compatible painting		
2.	Sample Holder Stage and Sample dimensions	• Automatic sample holder stage with x-y motion control • Spatial resolution ≤100 µm and max. screening area of at least 10 mm x 10 mm • Samples size: maximum up to four-inch diameter wafer		
3.	Hot plate (**Temperature**)	RT to ~200 °C in air, Heating rate: 0.01 up to 100°C/min Hot plate should be quoted as an optional item.		
4.	Pump & Probe Lasers	Pump and probe lasers with safety gears should be part of the system, with modulation frequencies of atleast 200 MHz.		
5.	Detector	• High speed data acquisition photodetector with high gain of atleast 500 kV/A and a maximum bandwidth of ≥ 400 MHz. • Lock-In-Amplifier with a sampling rate ≥ 125		

		MSa/s		
6.	Sample thickness range	~10 nm–20 µm		
7.	Anisotropic Thermal properties	Capability to measure anisotropic thermal properties, including both in-plane and cross-plane thermal conductivity, for directional analysis in materials such as 2D crystals.		
8.	Thermal Properties and ranges	• Thermal conductivity: 0.01 W/mK - 2000 W/mK • Thermal diffusivity: 0.01 mm^2/s - 1200 mm^2/s • Thermal boundary conductance: 0.1 MW/m^2K - 100 MW/m^2K • Volumetric specific heat capacity: 0.1 MJ/m^3K - 10 MJ/m^3K • Thermal effusivity: 1000 $Ws^{1/2}/m^2K$ - 100000 $Ws^{1/2}/m^2K$		
9.	Additional Ports (**Future Extension**)	Additional ports for integrated camera, vacuum chamber support system should be quoted with the system.		
10.	System Control	System Control using PC (Suitable Windows PC)		
11.	Electricity	AC ~ 230 V, 50 Hz, CE-certified electricity		
12.	System operation and maintenance manuals (paper, file)			
	Substrates to be used include:			
13.	Si, Si/SiO_2, Sapphire and quartz.			
14.	Wafer Sizes:	**Coupons, 2, 3, 4 (inch wafers)**		
	Programmable/Controllable features:			
15.	The system must offer fully programmable control over all thermal property measurements, enabling direct extraction of values without reliance on external parameters as inputs.			
16.	**Dimensions:** To fit within standard laboratory spaces.	Compact dimensions preferred, specify exact dimensions in the quote. Material: Stainless Steel with Cleanroom Compatible painting		
	Demonstration of the tool's capability:			
a.	**Thin film thermal conductivity measurement tool**: The system should be capable of measuring and producing various thin film material conductivities, including AlN, Al_2O_3, Metals (including Ag; Cu; Al), Polymers (including PMMA; Polystyrene), ensuring accurate values with minimal errors <5-10%.			
b.	Demonstration should include measurement setup and include emergency shutdown and start-up procedures.			

c.	Reference samples (thin (<50 nm) and thick (> 1 um)) of the same material, such as AlN or Al2O3 or Graphene etc should be provided along with factory data of multiple points (at least 5) measured across each sample to calibrate the tool as and when needed. Both, cross-plane and in-plane measurement data should be available.			
	Packaging and Shipment:			
a.	The thin film thermal conductivity measurement tool should be securely packed to prevent damage during transit, with all fragile components adequately cushioned.			
b.	The packaging should include necessary documentation, installation manuals, and a list of included components.			
	Acceptance Criteria:			
a.	Site Acceptance Test (SAT): • **The system must undergo SAT at the IITB site, replicating the factory acceptance test parameters with the following:** a) **Standard Samples Repeatability:** The vendor must demonstrate that the thin film thermal conductivity system can measure and give cross-plane and in-plane thermal conductivity values of standard samples >1 micron thick down to few tens of nm (< 50 nm) thickness of the same material such as AlN or Al2O3 or Graphene etc. To verify repeatability, the vendor performs the measurement on the standard samples on-site (atleast 5 points per sample and both in-plane and cross-plane thermal conductivity) and shows that the data matches factory data with an error of <5-10%. The vendor should also demonstrate measurement on a user-provided sample on-site within the specs of the tool.			
b.	**Installation and Qualification:** Installation and on-site qualification of the system by the OEM (Original Equipment Manufacturer).			
c.	**Training:** - On-site operational training for two engineers, covering system operation, maintenance, and basic troubleshooting. - Training shall be provided by the OEM authorized/ certified skilled personnel.			
d.	**Tool Performance Verification**	Data on standard reference factory samples is repeated on-site with a repeatability error of <5-10 % w.r.t factory data. The vendor also demonstrates measurement on a user-provided sample on-site within the specs of the tool. The vendor also demonstrates accurate measurements for various features of the purchased tool (e.g. temperature upto 200 ℃) on-site.		
e.	**Warranty:** One-year standard warranty.			